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DEPARTMENT OF LABOR

Occupational Safety and Health Administration

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AMMONIA

Proposed Standards for Exposure

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[29 CFR Part 1910]

[Docket No. H-053]

EXPOSURE TO AMMONIA

Proposed Standards

Pursuant to sections 6(b) and 8(c) of the Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1599; 29 U.S.C. 655, 657) and Title 29, Code of Federal Regulations (CFR) Part 1911, it is proposed to amend Part 1910 of 29 CFR by adding a new occupational safety and health standard for exposure to ammonia as § 1910.1031 and by deleting the present standard for ammonia contained in Table Z-1 of 29 CFR 1910.1000. This standard would apply to all employments in all industries covered by the Act, including "general industry", construction, and maritime. This standard would not apply to agricultural operations or to operations covered by 29 CFR 1910.111. In addition, pursuant to section 4(b)(2) of the Act (84 Stat. 1592, 29 U.S.C. 653), if the new standard, when promulgated, is determined to be more effective than corresponding standards now applicable to the maritime and construction industries contained in Subpart B of Part 1910, Parts 1915, 1916, 1917, 1918, and 1926 of 29 CFR, the new ammonia standard will supersede the corresponding maritime and construction standards for exposure to ammonia. Appropriate conforming amendments will be made in Subpart B of part 1910, and amendments to delete the superseded standards will be made in 29 CFR 1926.55 and in similar sections of Parts 1915–1918.

The accompanying document is a proposal issued pursuant to sections 6(b) and 8(c) of the Act. The agency requests the submission of written comments, data, and arguments from any interested persons on a variety of issues addressed or implicit in the proposal. In addition to filing comments, interested persons may also file objections to the proposal requesting an informal hearing with respect thereto.

In the development of this proposal the Occupational Safety and Health Administration (OSHA) has considered recommendations contained in the document "Criteria for a Recommended Standard—Occupational Exposure to Ammonia" which was developed for the Secretary of Labor by the National Institute for Occupational Safety and Health (NIOSH), Department of Health, Education, and Welfare. Further, additional information has been submitted by several independent sources in response to the advance notice of proposed rulemaking which was published in the FEDERAL REGISTER on December 27, 1974 (39 FR 44765).

The proposed standard contains a requirement limiting employee exposure to ammonia to a ceiling concentration of 50 parts per million (ppm) of air. The proposal also provides for employee exposure measurements, methods of compliance, personal protective equipment and clothing, training, limited medical surveillance, and recordkeeping.

The issues raised in the proposal include, among others, the following:

1. The replacement of the present time-weighted-average with a ceiling concentration limit;

2. The proposed permissible exposure and whether it should be raised or lowered;

3. The margin of safety that should be provided to protect employees from overexposure to any substance, in this case ammonia;

4. The limited nature of the medical surveillance program and, if such surveillance should be expanded, what elements should be included;

5. The feasibility of complying with a 50 ppm ceiling limit and;

6. The application of this standard to the storage and/or handling of anhydrous ammonia covered by 29 CFR 1910.111 and;

7. The application of the recordkeeping and similar requirements to small businesses and those with highly transient workforces.

I. BACKGROUND

A. *General.* Ammonia is synthesized by the combination of nitrogen and hydrogen. Hydrogen and nitrogen react at high temperature (400–6500 C) and pressure (100–900 atm) in the presence of an iron catalyst to produce ammonia. Ammonia is also produced as a by-product of coke production.

Ammonia is one of the most widely used industrial chemicals. Ammonia ranks fourth in volume of production after sulfuric acid, lime, and oxygen. Production in the United States in 1974 was about 15 million metric tons.

The greatest use of ammonia is in the fertilizer industry which accounts for about 74% of the ammonia produced. Ammonia is used as fertilizer either by direct application (26% of total use) or by conversion to various fertilizer derivatives such as ammonium sulfate, ammonium nitrate, urea, and diammonium phosphate. In addition to their use as fertilizers, urea is also used as an additive for feeds, and ammonium nitrate is used in over 80% of commercial explosives.

Ammonia is used in the manufacture of nylon intermediates (adipic acid, hexamethylenediamine, and caprolactam), acrylonitrile, terephthialates, aniline, polyurethane, melamine and urea resins, pharmaceuticals, food additives, detergents, insecticides, nitroparaffins, and hydrazine. Ammonia is also a major commercial refrigerant.

B. *History of regulation.* The maximum allowable concentration (MAC) for ammonia established by the U.S. Public Health Service in 1943 was a time-weighted-average (TWA) of 100 ppm. This level was adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) as their MAC for ammonia in 1946. This became the Threshold Limit Value (TLV) for ammonia in 1948. The following year the TLV was lowered to 50 ppm to protect against respiratory irirtation and eliminate most complaints of discomfort. This TLV was included in the ACGIH TLV list of 1968 and was adopted by the Department of Labor under the Walsh-Healey Public Contracts Act (41 U.S.C. 35 et seq.) and was then adopted in Table G-1 or § 1910.93 (now Table Z-1, § 1910.-1000) of the OSHA regulations under section 6(a) of the Occupational Safety and Health Act of 1970.

In 1969, ACGIH published a notice of intent to change the 50 ppm TWA to a 50 ppm ceiling limit. This proposed change was not adopted by ACGIH, rather, the 50 ppm TWA was changed to a 25 ppm TWA in 1973. ACGIH stated that this would minimize discomfort among uninsured workers.

This proposal would change the present 50 ppm TWA to a 50 ppm ceiling limit.

II. TOXICITY OF AMMONIA

A. *General properties.* Ammonia is an alkali with strong affinity for water which is the basis for its irritant properties with respect to the eyes, skin and mucous membranes.

Ammonia is fat-soluble as well as extremely water-soluble. The layers of cells of the eyes and skin tend to resist water-soluble substances, especially acids, restricting their penetration to only the outer cell layers. Alkalis, however, tend to break down and disrupt the outer cell layers permitting rapid penetration. The high pH is responsible for the breakdown of fats and structural alteration of proteins.

As the mechanism for injury to the outer layers is similar for all alkalis, the determining factor in speed and extent of penetration is the water solubility of the chemical. Ammonia is very soluble and therefore can be very hazardous causing burns on contact.

B. *High level exposures.* Inhalation of ammonia vapor in high concentrations results in acute congestion and edema of the respiratory mucosa, dyspnea, bronchospasm and chest pain. Production of pink frothy sputum often occurs.[1, 2] Exposure to airborne concentrations of ammonia of several thousand parts per million of air can be fatal. Consequences can include bronchitis or pneumonia. Some residual reduction in pulmonary function has been reported after the acute trauma have healed.[1]

C. *Low level exposures.* Symptoms resulting from lower level exposures are not as well defined as those from high level exposures. Symptoms such as nose, eye or throat irritation have been reported both from occupational exposures and human experiments. The ammonia concentrations in these situations are generally below 500 ppm.

A survey of a blueprint shop by Mangold[3] reported ammonia concentrations of 4–29 ppm which resulted in "barely noticeable" to "moderate" eye irritation

[1] All Footnote references appear at the end of Part IV of the preamble.

among the 8 workers in the shop. No respiratory irritation was reported.

A review conducted by the Commonwealth of Massachusetts, cited by NIOSH,[4] summarized results of surveys of ammonia concentrations at several sites. Levels of ammonia at printing machines in 2 surveys were at 45 ppm. This level resulted in transient eye irritation in one instance and only the strong odor of ammonia in the other. The distinct odor of ammonia was reported at another printing machine with ammonia concentrations of 3–29 ppm. "Very slight" eye irritation was reported at an insole cementing operation where the ammonia levels were 15–28 ppm. General statements that an ammonia level of 125 ppm was "definitely irritating" and that a level of 55 ppm was not excessive were made by Elkins.[5] Vigliani and Zurlo[6] concluded, without describing their method, that 100 ppm could not be continuously inhaled for lengthy periods without irritation of the upper respiratory tract and eyes.

The NIOSH criteria document[4] states that there has been little attention given to the possibility of chronic effects due to low-level exposure to ammonia. NIOSH cites two studies concerning this possibility. One study of a small worker population in an Egyptian ice plant, for whom no exposure data were given, reported no adverse effects on ventilatory function or respiratory symptomology as a result of ammonia exposure.[11] Another report, also cited by NIOSH, implicated ammonia as an occupational carcinogen in a group of chemical workers.[12] This study presents insufficient information on the work population, on the exposures involved, and on the methods used in the study. The conclusions are, therefore, unconvincing in the absence of more complete data. These 2 reports apparently are the only published attempts to identify chronic effects, if any, of long-term exposure to ammonia.

D. *Human exposure expirements.* Seven subjects were exposed to 500 ppm of ammonia for 30 minutes using an oral-nasal mask in an experiment conducted by Silverman et al.[7] All experienced upper respiratory irritation which was subjectively reported as "severe" in 2 subjects. Two subjects experienced lacrymation although no direct contact was reported between the ammonia and the eyes. Blood urea nitrogen, non-protein nitrogen, urine, urea and urine ammonia levels were unchanged. Pulse rate and blood pressure were measured in 2 subjects. Both parameters increased slightly in 1 subject and were unchanged in the other.

MacEwen, et al.[8] exposed 6 subjects to 30 and 50 ppm for 10 minutes. At 50 ppm, 4 of 5 subjects reported irritation which was rated as moderate, 1 reported faint irritation, and 1 reported no irritation. Irritation at 50 ppm was not reported to be dsicomforting or painful. All 6 rated odor at 50 ppm highly penetrating, 3 gave the same rating to the odor at 30 ppm. All responses for irritation and odor were subjective only.

[1] All Footnote references appear at the end of Part IV of the preamble.

Industrial Bio-Test Laboratories, Inc. conducted an ammonia irritation threshold study using 10 subjects.[9] Exposures were at concentrations of 32, 50, 72, and 134 ppm for 5 minutes at each concentration. Subjective responses for eye, nasal, throat and chest irritation which persisted throughout the five-minute exposure period were reported. Nasal dryness was reported by 1 subject at 32 ppm and 2 subjects at 50 ppm. At 72 ppm, eye and throat irritation was reported by 3 subjects and nasal irritation by 2 subjects. At 134 ppm 5 subjects showed signs of lacrymation, 5 had eye irritation, 7 had nasal irritation, 8 had throat irritation and one complained of chest irritation. Concentrations below 50 ppm were concluded to be nonirritating.

In a recently completed study,[10] submitted to OSHA subsequent to the completion of the NIOSH criteria document, Allied Chemical Corp. reported no significant changes in blood pressure, pulse, respiratory rate and pulmonary function in 6 subjects exposed to 25, 50, and 100 ppm for 2, 4 and 6 hours. The test program lasted for 5 weeks. The subjects were examined by a physician before and after exposure for the condition of the mucosa of the eyes, nose, and throat.

The subjects, none of whom had any previous ammonia exposure, experienced no discomfort at any of the 3 exposure levels. The preliminary data indicates no changes in pulmonary function. Pulse, respiration, and blood pressure also appear to be unchanged except for transient increases occurring during brief exercise periods during exposure. Irritation of eyes, nose, and throat as found by the examining physician seem to follow no pattern in occurrence or severity. Mild nasal irritation was the most frequent, being found in all subjects at both 50 and 100 ppm, but not in a pattern of increasing frequency with increasing exposure level. Two subjects experienced as much nasal irritation at 25 ppm as at 50 or 100 ppm. Three subjects had no eye irritation, and 2 had no throat irritation at any level. Headache was subjectively reported by 3 subjects, but without any apparent relationship to length or degree of exposure.

III. Pertinent Legal Authority

The primary purpose of the Act is to assure, so far as possible, safe and healthful working conditions for every working man and women. One means prescribed by Congress to achieve this goal is the authority vested in the Secretary of Labor to set mandatory safety and health standards. The standards setting process under section 6 of the Act is an integral part of an occupational safety and health program in that the process permits the participation of interested parties in consideration of medical data, industrial processes and other factors relevant to the identification of hazards. Occupational safety and health standards provide notice of the requisite conduct or exposure level and provide a basis for ensuring the existence of safe and healthful workplaces. The Act provides that:

> The Secretary, in promulgating standards dealing with toxic materials or harmful physical agents under this subsection, shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life. Development of standards under this subsection shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of heath and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws. (Section 6(b)(5))

Where appropriate, the standards are required to include provisions for labels or other forms of warning to apprise employees of hazards, suitable protective equipment, control procedures, monitoring and measuring of employee exposure, employee access to the results of monitoring, and appropriate medical examinations. Moreover where a standard prescribes medical examinations or other tests, they must be made available at no cost to the employees (section 6(b)(7)). Standards may also prescribe recordkeeping requirements where necessary or appropriate for enforcement of the Act or for developing information regarding occupational accidents and illness (section 8(c)).

IV. The Proposal

A. *Scope and application.* The proposed standard would apply to all workplaces in all industries, including construction and maritime as well as "general industry", where ammonia is occupationally present or released and over which OSHA has jurisdiction. This standard would not apply to agricultural operations or to operations covered under 29 CFR 1910.111. However, not all requirements of the standard will apply to every employer regardless of the conditions in the workplace. Where an employer determines in accordance with § 1910.1031 (d) that employee exposure is below the ceiling limit, only provisions such as training, housekeeping, hygiene practices and recordkeeping will be applicable. Where exposures reach or exceed the ceiling limit, additional requirements would apply, including medical surveillance and a full air monitoring program. Exposures to airborne concentrations of ammonia in excess of the ceiling limit trigger additional requirements, including: Reduction of exposures to below the ceiling limit by means of engineering controls supplemented by work practice controls; use of specified respirators; and use of appropriate protective clothing and equipment.

B. *Exposure level.* The present standard for exposure to ammonia is an 8 hour time-weighted-average of 50 ppm. The implication of a time-weighted-average is that there is a hazard of chronic illness from exposure, and that, therefore, exposures must be maintained at a consistently low level over time to prevent

cumulative effects. Exposures may be permitted to fluctuate within a range of values as long as the average level of exposure, calculated over an entire workday, is below the permissible level.

As to ammonia, however, no evidence of chronic illness from a long-term exposure exists, other than the one report concerning cancer which, as previously discussed, has been found unconvincing. The concept of a time-weighted-average as applied to ammonia is, therefore, inappropriate. Rather than posing a chronic hazard, ammonia vapor is an irritant. Thus, the concentration inhaled is more significant than the length of exposure. A standard expressed as a ceiling then is the more appropriate means of regulating ammonia, since it would prevent excursions to more irritating concentrations.

The proposal includes a ceiling limit of 50 ppm as determined by a sampling time of no more than 5 minutes.

While preliminary data submitted to OSHA by Allied Chemical Corp. In August 1975 suggests that 100 ppm is an appropriate level, other evidence supports 50 ppm as the appropriate ceiling limit.

A report by Elkins[6] stated that an ammonia concentration of 55 ppm was not excessive but at higher levels was "definitely irritating." Irritation at 50 ppm was not reported to be discomforting or painful in a study conducted by MacEwen,[8] although it was noticeable. Industrial Bio-Test Laboratories, Inc. conducted an ammonia irritation threshold study and concluded that 50 ppm was non-irritating.[9] Moreover, this proposal reflects the recommendations made by NIOSH in the criteria document on ammonia[4] that a ceiling limit of 50 ppm is both necessary and adequate to protect the safety and health of employees.

(C). *Determination and measurement of exposure.* The employer would be required by the proposal to make an initial determination of employee exposure to airborne concentrations of ammonia. This determination may be an observation based on the amount of ammonia present in the workplace, type of operations being performed, the amount and type of ventilation, and the proximity of employees to the sources of emission. Also, the employer must consider any employee complaints of symptoms that may be attributable to ammonia exposure.

When making this determination, the employer is not required to sample or measure airborne concentrations of ammonia. However, if the employer has made any measurements at this time, these must also be considered in the initial determination. In making the initial determination, the employer must be certain that the determination accurately reflects employee exposure conditions over the entire workday.

In establishments having more than one work operation involving the use of ammonia, an initial determination must be made for each operation. Also the determination must be repeated each time there is a change in production, process, or control measures which could result in new or additional exposures, or whenever the employer has any other reason to suspect that a change in exposure conditions has occurred.

If the results of the initial determination are negative, that is, if the employer determines that no employee is exposed to airborne concentrations of ammonia in excess of the ceiling limit, a written record of this determination must be made. This record must contain any information or observations that indicate an employee may be exposed to airborne concentrations of ammonia, including employee complaints of symptoms that may be attributable to such exposure. Further, the determination record must include measurements of ammonia that have been made (although none are required to be made for the initial determination), and the names and social security numbers of the employees involved in operations where ammonia is present.

If the results of the initial determination of exposure to airborne concentrations are positive, indicating that an employee may be exposed to airborne concentrations of ammonia in excess of the ceiling limit, the employer would be required by the proposed standard to measure the exposure of the employee believed to have the greatest exposure. If more than one initial determination is positive, the employer must measure the exposure of the employee believed to have the highest exposure in each work operation for which a positive determination was made.

When the results of the single employee's exposure measurement reveal exposure in excess of the ceiling limit, the employer would be required to identify all other employees who may be similarly exposed, and to measure the exposures of each of these employees. The proposed standard contains detailed instructions for monitoring the exposure of such employees.

The measurement procedure may be terminated if the single employee exposure measurement does not indicate exposure in excess of the ceiling limit. However, it should be noted that if an employer has knowledge of a change in production, process, or control measures which could result in increased exposures to ammonia, or if the employer has any other reason to suspect that a change in exposure conditions has occurred, the initial determination procedure must be repeated. Under these monitoring provisions, employers who have workplaces in which exposures to ammonia are below the ceiling limit would not be required to make continuing regular measurements.

D. *Methods of measurement.* The proposal would require that exposure measurements reflect the actual exposure conditions for each employee. Measurements are to be made by breathing zone samples in order to accurately reflect such exposure conditions. The concentration is to be determined by a sampling time of no more than 5 minutes to permit measurement of peaks that might be missed with longer sampling times.

The sampling method must have an accuracy (with a confidence level of 95%) ±25% above 50 ppm, which is the NIOSH Test Concentration for ammonia.[4] The term "accuracy" refers to the difference between the measured value and the true concentration. It allows for both the random variation of the method (its precision) and the difference between the average result from the method and the true value (bias of the method). As noted, the required accuracy for concentrations of ammonia above 50 ppm is 25% at a 95% confidence level This means that out of a large number of samples, 95% of the measurements obtained must be within 25% of the true value. Methods are currently available for sampling ammonia which can achieve the required accuracy within the 5 minute sampling time limit.[4]

E. *Methods of compliance.* The proposed standard would require the employer to immediately institute engineering controls to reduce employee exposure to below the ceiling limit, except in situations where such controls are infeasible. Further, in situations where the engineering controls that can be instituted immediately will not reduce exposures to below the ceiling limit, they must, nonetheless, be used to reduce exposure to the lowest practicable level, and be supplemented by the use of work practices.

Whenever engineering controls and work practices will not reduce exposures to below the ceiling limit, they must be further supplemented by respiratory protection. In addition, a program must be established and implemented to reduce exposures to within the permissible exposure limits, or to the greatest extent feasible, solely by means of engineering controls. Written plans for this program must be developed and furnished upon request for examination and copying to representatives of the Secretary and the Director. These plans must be reviewed and updated at least every 6 months to reflect the current status of exposure control.

Engineering controls are the preferred means of compliance because they reduce exposure hazards in the workplace environment by removing the airborne contaminants. Engineering controls may include the installation of local exhaust ventilation or the modification of a process so as to reduce emission of the contaminant into the workplace. Whenever mechanical ventilation is used as an engineering control, checks of air system efficiency, such as capture velocity, duct velocity, or static pressure must be made at least every 3 months. There checks are necessary to assure that the primary control system (mechanical ventilation) is functioning effectively.

Whenever engineering controls prove to be infeasible or inadequate to maintain airborne concentrations of ammonia below the ceiling limit, work prac-

[1] All Footnote references appear at the end of Part IV of the preamble.

tices become the preferred means of compliance. Work practice controls include, for example, adherence to proper process techniques and proper maintenance. However, work practice controls are effective only when strong supervisory control is maintained.

Whenever both engineering and work practice controls are infeasible or inadequate to maintain the exposure to below the ceiling limit, they must be supplemented by the use of respirators. Respirators are the least satisfactory means of control because of certain difficulties inherent in their use. Respirators are capable of providing good protection only if they are properly selected for the concentrations of airborne contaminants present, properly fitted to the employee, worn by the employee, and replaced when they have ceased to provide protection. While it is thoretically possible for all of these conditions to be met, it is often the case that they are not, and as a consequence, the protection of employees by respirators is not as effective as the other methods of compliance.

F. *Fire and safety.* The proposed standard would require the employer to become familiar with the guidelines for the safe handling and use of ammonia. These guidelines are found in Appendix B. The guidelines deal with fire and explosion hazards inherent in ammonia and, together with other provisions of this paragraph, provide a basic reference to the requirements of other standards applicable to ammonia.

G. *Medical surveillance.* The medical surveillance program in the proposal is limited. As no identified chronic illness is associated with long-term ammonia exposure, OSHA believes that initial and periodic medical examinations may not be necessary in this case. OSHA requests that this issue be specifically addressed in any submissions in response to this proposal. An initial screening of employees to determine those who might experience difficulty if exposed to ammonia is required. If the results of such screening disclose the existence of certain conditions, the employer must provide a medical examination. Pre-existing chronic respiratory, eye, or skin disease may place the employee at increased risk from exposure to ammonia and may make the wearing of required protective equipment intolerable.

If any employee has accidentally or otherwise been exposed to ammonia by ingestion, inhalation, or by skin or eye contact under conditions known or suspected to be hazardous or, develops signs or symptoms commonly associated with exposure to ammonia or becomes aware of medical conditions, such as chronic respiratory, eye, or skin disease, the employee should notify the employer. Upon such notification, the employer shall provide such employee with a medical examination.

The employer must provide the examining physician with a copy of the standard for ammonia including appendixes, a description of the employee's duties, a description of any personal protective equipment used by the employee, the results of the employee's exposure measurement, and an estimate of the levels to which the employee will be exposed. The employer must also provide any available medical history information requested by the physician.

Following the medical examination, the employer must obtain a written opinion from the examining physician stating whether the employee has any medical conditions that would place the employee at increased risk, or that would be aggravated by exposure to ammonia. Additionally, the opinion must state any recommended limitations upon the employee's exposure or upon the employee's use of protective equipment and respirators. The opinion must also state that the employee has been informed of any medical conditions which require further examination or treatment, although the written opinion may not contain specific findings or diagnoses unrelated to the employee's exposure to ammonia. The employer must provide a copy of the physician's opinion to the affected employee.

If, based on the physician's opinion, the employer determines that exposure above the ceiling limit of an employee to ammonia would impair the employee's health, it is the responsibility of the employer to remove the employee from exposure.

H. *Employee information and training.* Information and training are essential for the protection of employees because employees can do much to protect themselves if they are informed of the nature of the hazards in the workplace. To be effective, an employee education system must apprise the employee of the specific hazards associated with the work environment. For this reason the employer would be required to inform each employee of the effects of ammonia, the necessity for exposure control and the medical and industrial hygiene monitoring programs. Further, the employee must be instructed to report promptly the development of symptoms or conditions which could be attributed to overexposure to ammonia. Appropriate labels are also required.

I. *Housekeeping and sanitation.* The proposed standard would require employers to ensure that appropriate action is taken to clean up spills and to maintain a clean workplace. The proposed standard would also require employers to provide appropriate washing facilities and emergency eye wash facilities.

J. *Recordkeeping.* The proposed standard would require employers to keep written records of the following: Initial determinations which indicate that employees are not exposed above the ceiling limit; measurements of employee exposure; tests of mechanical ventilation system efficiency (where such systems are used for engineering control); annual training and information sessions; medical examinations; and pre-placement histories.

Records of negative determinations are necessary in part to show that the employer did in fact examine the establishment to consider whether or not a potentially hazardous situation existed, and to preserve the results of such determinations.

Records of positive determinations are not needed because such results require the employer to take other actions which would show that the employer has made the attempt to examine exposures in the work place.

A record of the tests of mechanical ventilation system efficiency is required to be maintained to ensure that tests of the system are being made at the required time intervals. Further, the record is useful to the employer, since the evaluation of the data obtained in any individual test is needed to compare the most recent test with previous tests to detect any trends that may be occurring. The employer or compliance officer may also use these records to determine which control system may be inoperative or defective and, thus, devise an efficient employee exposure measurement sampling scheme.

Section 8(c)(3) of the Act requires, and paragraph (1) of this proposal contains provisions for, access to records of exposure measurements by employees, former employees or their representatives, and for access to medical records made pursuant to paragraph (1) by physicians designated by employees or former employees. It should be noted that such access is limited only to the records of determinations, exposure measurements, and medical examinations that are being maintained by the employer in accordance with the recordkeeping requirements, and that the employer is not required to retain or make those records accessible for periods longer than those required in paragraph (1).

K. *Observation of monitoring.* Section 8(c)(3) of the Act requires employers to provide employees or their representatives with the opportunity to observe monitoring of employee exposures to toxic materials or harmful physical agents. In accordance with this section, the proposed standard contains provisions for such observation. To ensure that the right to observe is meaningful, observers would be entitled to receive an explanation of the measurement procedure, to observe all steps related to the measurement procedure, and to record the results obtained.

It should be noted that the observer, whether an employee or designated representative, must be provided with and required to use any personal protective devices required to be worn by employees working in the area that is being monitored, and must comply with all other applicable safety procedures.

L. *Appendixes.* Two appendixes have been included in this proposal: Appendix A, "Substance Safety Data Sheet"; Appendix B, "Substance Technical Guidelines." It should be noted that the appendixes have been included for informational purposes. None of the statements contained therein should be con-

strued as imposing a mandatory requirement which is not otherwise imposed, or as negating any requirement which is imposed by the standard.

The information contained in Appendixes A and B is meant to aid the employer in complying with requirements of the standard. This information is also to be provided to employees as part of the annual training and education program.

REFERENCES

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[9] Industrial Bio-Test Laboratories, Inc., Irritation Threshold Evaluation Study with Amonia, Report to the International Institute of Ammonia Refrigeration, IBT 663–03161, March 23 1973.

[10] Allied Chemical Corp., Ammonia Test Program, Preliminary report submitted to OSHA, August 15, 1975.

[11] El-Sewefy, A.Z. and S. Awad, "Chronic bronchitis in an Egyptian ice factory: J. Egyptian Med Assoc. 54:304–310, 1971.

[12] Bittersohl, G. "Epidemiologic study on cancer of workers in a chemical plant", Abstract resume S9–05, International Congress on Occupational Health Sept. 22–27, 1969 Tokyo, Japan.

V. ENVIRONMENTAL IMPACT ASSESSMENT

The National Environmental Policy Act of 1969 (42 U.S.C. 4321–4347), requires, among other things, that Federal agencies assess their proposed major actions, including rulemaking, to determine whether a significant impact on the quality of the human environment may result. Furthermore, 29 CFR 1999.3(d) requires that where OSHA determines that an environmental impact statement should be prepared, the determination to do so must be published in the FEDERAL REGISTER. Accordingly, it is hereby noticed that OSHA intends to prepare an environmental impact statement on the proposed standard for occupational exposure to ammonia in accordance with the requirements of 29 CFR Part 1999.

Once the draft environmental impact statement has been prepared, a copy of it will be made available by OSHA to any member of the public who requests an opportunity to comment on it. Any person or agency submitting comments on it to OSHA must at the same time forward 5 copies of the comments to the Council on Environmental Quality, 722 Jackson Place, NW., Washington, D.C. A 45-day period will be allowed for the submission of comments after the publication of the notice of availability of the draft environmental impact statement. The draft statement will be available, where practicable, at least 15 days prior to a public hearing on the proposed standard. The environmental impact of the proposal would be an appropriate issue at such hearing.

It appears at present that the preceding preamble to the proposed standard for occupational exposure to ammonia adequately assesses the impact of the proposal on the workplace environment. It further appears that the proposed standard for occupational exposure to ammonia will have no significant effects on the quality of the human environment external to the workplace. The proposal does not increase the amount of ammonia permitted to be released into the ambient air, nor does the proposal call for changes of industry practice in disposal of ammonia wastes. For these reasons, OSHA does not anticipate any increased impact on the community contiguous to establishments in which ammonia is used or produced.

Interested persons may submit comments that may be helpful in preparing the draft environmental impact statement on the proposed standard. Any person having relevant information or data not readily available in the open literature is invited to submit it to David R. Bell, Office of Standards Development, Occupational Safety and Health Administration, U.S. Department of Labor, 200 Constitution Avenue, N.W., Room N3669, Washington, D.C. 20210, by December 26, 1975. Comments submitted in regard to the proposed standard need not be resubmitted. All material received on environmental impact will be available for public inspection and copying at the above address.

VI. PUBLIC PARTICIPATION

Interested persons are invited to comment on the proposed standard on or before January 26, 1976. Written data, views, and arguments concerning the proposal must be submitted in quadruplicate to the Docket Officer, Docket No. H–053, U.S. Department of Labor, Room N3620; 200 Constitution Avenue, NW., Washington, D.C. 20210 (telephone: 202/523–8076). Written submissions must clearly identify the provisions of the proposal addressed and the position taken with respect to each provision. The data, views, and arguments will be available for public inspection and copying at the above address. All written submissions received will be made a part of the record.

Pursuant to 29 CFR 1911.11(b) and (c), interested persons, in addition to filing written matter as provided above, may file objections to the proposal requesting an informal hearing with respect thereto, in accordance with the following conditions:

1. The objections must include the name and address of the objector;

2. The objections must be postmarked on or before January 26, 1976;

3. The objections must specify with particularity the provisions of the proposed rule to which objection is taken and must state the grounds therefor;

4. Each objection must be separately stated and numbered; and

5. The objections must be accompanied by a detailed summary of the evidence proposed to be adduced at the requested hearing.

In addition to the proposal and its environmental impact, OSHA hereby solicits comments from interested persons regarding the potential inflation impact of the proposed standard. These comments must be submitted in accordance with the requirements for comments on the proposal. Comments may be directed toward any of the following subjects:

1. Cost impact on consumers, businesses, markets, and Federal, state, or local governments;

2. Effect on the productivity of wage earners, businesses, or government;

3. Effect on competition;

4. Effect on supplies of important materials, products or services;

5. Effect on employment; and

6. Effect on energy supply or demand.

It is OSHA's intention to prepare an inflation impact statement and analysis if appropriate, or a certification that the standard has no substantial inflationary impact, and to make such statement or certification available at least 30 days prior to any public hearings on the proposed standard. The potential inflationary impact of the proposed standard would be an appropriate issue at such hearings.

Accordingly, pursuant to sections 6(b) and 8(c) of the Occupational Safety and Health Act of 1970 (84 Stat. 1953, 1599; 29 U.S.C. 655, 657) and 29 CFR Part 1911, it is hereby proposed to amend Part 1910 of Title 29 of the Code of Federal Regulations as set forth below.

Signed at Washington, D.C. this 14th day of November, 1975.

JOHN T. DUNLOP,
Secretary of Labor.

§ 1910.1000 [Amended]

1. Table Z–1 in § 1910.1000 is proposed to be amended by deleting the following:

* * * * * *

Ammonia	50 ppm (35 mg/m³)

* * * * * *

2. A new § 1910.1031 is proposed to be added to Part 1910 of Title 29 of the Code of Federal Regulations, reading as follows:

§ 1910.1031 Ammonia.

(a) *Scope and application*—(1) This section includes requirements for the control of employee exposure to ammonia.

(2) This section applies to the production, release, storage, handling, packag-

ing, repackaging, transportation, or use of ammonia, except as to working conditions with respect to which any other Federal agency has exercised statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health hazards covered by this section.

(3) This section shall not apply to operations covered by 29 CFR 1910.111.

(b) *Definitions*—"Ammonia" means gaseous or liquified anhydrous ammonia or aqueous solutions thereof.

"Strong aqua ammonia" means aqueous solutions containing more than 10% ammonia.

"Weak aqua ammonia" means aqueous solutions containing 10% or less ammonia.

"Emergency" means any occurrence such as, but not limited to, equipment failure or failure of control equipment which is likely to or does result in an unexpected exposure to ammonia in excess of the permissible exposure limit.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare or the Directors' designee.

"Secretary" means the Secretary of Labor, U.S. Department of Labor, or the Secretary's designee.

(c) *Permissible exposure limits*—(1) *Ceiling limit.* No employee may be exposed to an airborne concentration of ammonia in excess of 50 ppm (35 mg/m^3 as determined by a sampling time of not more than 5 minutes.

(2) *Dermal exposure.* No employee may be exposed to liquefied anhydrous ammonia or aqueous solutions thereof by skin or eye contact.

(d) *Determination and measurement of exposure*—(1) *Initial determination of requirement for measurement.* Each employer who has a place of employment in which ammonia is present, shall inspect each workplace and work operation to determine if any employee may be exposed, without regard to the use of respirators, to airborne concentrations of ammonia in excess of the ceiling limit. Such a determination shall be based on the following, along with any other relevant considerations:

(i) Any information, observations, or calculations which would indicate employee exposure to airborne ammonia; and

(ii) Any measurements of airborne ammonia; and

(iii) Any employee complaints of symptoms which may be attributable to exposure to airborne ammonia.

(2) *Negative determination.* Whenever a determination is made that no employee may be exposed to airborne concentrations of ammonia in excess of the ceiling limit, the employer shall make a record of such determination. The employer shall include in this record at least the information specified in paragraph (d)(1) of this section, and shall also include the date of the determination, work being performed at the time, the location within the work site, and the names and social security numbers of employees involved in operations where airborne ammonia is present.

(3) *Positive determination.* Whenever a determination conducted under paragraph (d)(1) of this section indicates the possibility of any employee exposure in excess of the ceiling limit, without regard to the use of respirators, the employer shall measure the exposure of the employee believed to have the greatest exposure. The employer shall make an exposure measurement which is representative of the maximum exposure of the employee.

(4) *Similarly exposed employees.* If the exposure measurement taken pursuant to paragraph (d)(3) of this section reveals employee exposure to airborne concentrations of ammonia in excess of the ceiling limit, the employer shall identify all employees who may be similarly exposed, and measure the exposures of such employees by use of breathing zone samples.

(5) *Exposures in excess of the ceiling limit.* If exposure measurements reveal an employee's exposure to be in excess of the ceiling limit, the employer shall:

(i) Inform each such employee in writing of the exposure as required by paragraph (d)(9) of this section; and

(ii) Measure the exposure of each such employee at least monthly.

(6) *Discontinuance of measurement.* If two consecutive measurements, taken at least one week apart, reveal that an employee is exposed to airborne concentrations of ammonia below the ceiling limit, the employer may discontinue exposure measurement for that employee.

(7) *Record.* The employer shall make a record of all measurements and shall include at least the information required in paragraphs (d)(1) and (2) of this section.

(8) *Redetermination.* Whenever there has been a production, process, or compliance method change which may result in new or additional exposures, or whenever the employer has any other reason to suspect a change in exposure conditions, the employer shall make a new determination under paragraph (d)(1) of this section.

(9) *Employee notification.* The employer shall individually provide each employee in writing with the results of that employee's exposure measurement within 5 working days after the receipt of such measurement results. The employer shall also individually provide to each employee written notice of the corrective action being taken to reduce exposure to within permissible limits, within 5 days after the determination of necessary corrective action.

(10) *Accuracy of measurement.* The employer shall use a method of measurement which has an accuracy (with a confidence level of 95%) of not less than plus or minus 25% for concentrations of airborne ammonia greater than or equal to 50 ppm.

(e) *Methods of compliance*—The employer shall control employee exposure by skin or eye contact with ammonia as set forth in paragraph (e)(3) of this section. The employer shall also control employee exposures to airborne concentrations of ammonia to below the ceiling limit provided in paragraph (c) of this section by engineering controls, work practices, and respiratory protection controls as follows:

(1) *Engineering and work practice controls.* (i) The employer shall immediately institute engineering controls to reduce exposures to below the ceiling limit, except to the extent that such controls are not feasible.

(ii) Whenever feasible engineering controls which can be instituted immediately are insufficient to reduce exposures to below the ceiling limit, the employer shall, nonetheless, use engineering controls to reduce exposures to the lowest practicable level, and shall supplement them by work practice controls.

(iii) Whenever feasible engineering controls and supplemental work practice controls are insufficient to reduce exposures to below the ceiling limit, the employer shall, nonetheless, implement them to reduce exposures to the lowest practicable level and shall supplement them with respiratory protection in accordance with paragraph (e)(2) of this section.

(iv) The employer shall establish and implement a program to reduce exposures to below the ceiling limit, or to the greatest extent feasible, solely by means of engineering controls.

(v) The employer shall develop written plans for such a program and shall furnish them upon request to the Secretary and the Director. The employer shall review and revise such plans at least every 6 months to reflect the current status of the program.

(vi) Whenever mechanical ventilation is used to control exposure, the employer shall make measurements which demonstrate the effectiveness of the system to control the exposures to below the ceiling limit such as capture velocity, duct velocity, or static pressure, at least every 3 months. The employer shall also make measurements of the system's effectiveness to control exposure to below the ceiling limit within 5 days after any change in production, process, or control which might result in any change in airborne concentrations of ammonia.

(2) *Respiratory protection.*—(i) *Permitted use.* The employer may not achieve compliance with the permissible exposure limit by the use of respirators except:

(A) During the time period necessary to install engineering controls; or

(B) During work operations in which engineering controls are not feasible; or

(C) In work situations in which engineering controls and work practices are insufficient to reduce exposures to below the ceiling limit; or

(D) In emergencies.

(ii) *Respirator selection.* (A) Whenever respiratory protection equipment is to be used in accordance with this section, the employer shall select the appropriate respirator from the table below, provide such respirator, and ensure that the employee uses the respirator provided.

Requirements for Respirator Usage	
Concentration of Ammonia:	*Permissible respiratory protection*
Not in excess of 500 ppm.	Chemical cartridge respirator for ammonia with full facepiece. (30 CFR 11.150)
Not in excess of 1250 ppm.	Gas mask with front- or back-mounted chest type canister for ammonia. (30 CFR 11.90 (a) (1))
	Type C supplied-air respirator, demand (negative pressure); pressure-demand; or continuous flow type with full facepiece. (30 CFR 11.110)
	Self-contained breathing apparatus in demand mode (negative pressure) with full facepiece. (30 CFR 11.70(a) (2) (i))
In excess of 1250 ppm, or unknown.	Self-contained breathing apparatus in pressure-demand mode (positive pressure). (30 CFR 11.70(a) (2) (ii))

(B) The employer shall select respirators from those approved by the Mining Enforcement and Safety Administration (formerly called the Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provision of 30 CFR Part 11.

(C) Respirators prescribed for higher concentrations may be used for any lower concentration.

(iii) *Respiratory protection program.* (A) The employer shall institute a respiratory protection program in accordance with § 1910.134.

(B) The employer shall allow employees who wear respirators to leave work areas to wash their faces and respirator facepieces to prevent potential skin irritation associated with respirator use.

(3) *Personal protective equipment.*—(i) *Skin contact.* The employer shall provide, and ensure that employees wear, impervious clothing, gloves, face shields (8 inch minimum), and other appropriate protective clothing, as necessary to prevent skin contact with liquified anhydrous ammonia or aqueous solutions thereof. Face shields shall comply with § 1910.133(a) (2)–(a) (6).

(ii) *Eye contact.* The employer shall provide, and ensure that employees use, cup-cover type dust- and splash-proof safety goggles, as specified in § 1910.133 (a) (2)–(a) (6), as necessary to prevent eye contact with liquefied anhydrous ammonia or aqueous solutions thereof.

(f) *Fire and safety*—(1) The employer shall become familiar with the information contained in the Substance Technical Guidelines (Appendix B of this section) for ammonia.

(2) For the purpose of compliance with § 1910.309, locations classified as hazardous locations due to the presence of ammonia shall be Class I, Group D.

(3) For the purpose of compliance with § 1910.157, ammonia is classified as a Class B fire hazard.

(4) For the purpose of compliance with § 1910.178, locations classified as hazardous locations due to the presence of ammonia shall be Class I, Group D.

(g) *Housekeeping and sanitation*—(1) *Housekeeping.* (i) The employer shall ensure that spills of ammonia be cleaned up immediately by personnel wearing appropriate protective equipment.

(ii) The employer shall ensure that the workplace be kept clean in accordance with § 1910.141(a) (3).

(2) *Sanitation.* (i) The employer shall provide adequate washing facilities, soap, water, and towels in accordance with § 1910.141(d) where ammonia is produced, released, stored, handled, packaged, repackaged, transported, or used.

(ii) The employer shall provide eye wash facilities that are suitable for quick drenching or flushing of the eyes with copious amounts of water for at least 15 minutes, for immediate emergency use where ammonia is produced, released, stored, handled, packaged, repackaged, transported or used.

(h) *Emergency situations*—(1) *Written plan.* (i) The employer shall develop a written plan for emergency situations for each facility involved in ammonia operation in which there is a possibility of an emergency as defined in paragraph (b) of this section. The employer shall ensure that appropriate portions of the plan be implemented in the event of an emergency.

(ii) Any such plan shall specifically provide that employees engaged in correcting emergency conditions be equipped as required in paragraphs (e) (2) and (e) (3) of this section until the emergency is abated.

(iii) The employer shall ensure that employees not engaged in correcting the emergency be restricted from the area and that normal operations in the affected area not be resumed until the emergency is abated.

(2) *Alerting employees.* The employer shall develop and use a system or procedure to promptly alert employees of the occurrence of an emergency.

(i) *Medical surveillance*—(1) *General requirements.* (i) Each employer who has a place of employment in which employees may be exposed by contact with liquified anhydrous ammonia or agueous solutions thereof, or to airborne concentrations of ammonia above the ceiling limit, without regard to the use of respirators, shall institute a medical surveillance program.

(ii) The program shall provide each employee covered under paragraph (i) (1) (i) of this section with an opportunity for medical examinations, when required under paragraphs (i) (2) and (3) of this section.

(iii) The employer shall ensure that all medical examinations and procedures be performed by or under the supervision of a licensed physician, and be provided during the employee's normal working hours, without cost to the employee.

(2) *Preplacement examination.* (i) Prior to assigning any employee to an operation in which the employee may be exposed to ammonia, as specified in paragraph (i) (1) (i) of this section, the employer shall require from the employee a statement for the medical record as to whether or not the employee has a history of the following:

(A) Chronic respiratory disease.

(B) Chronic eye disease.

(C) Chronic skin disease.

(ii) If the employee provides a history of any of the conditions named in paragraph (i) (2) (i) of this section, the employer shall provide a medical examination appropriate to the reported condition.

(iii) The employer shall ensure that no employee be exposed to ammonia if, based on the written opinion of the examining physician, such exposure could place the employee at increased risk because of pre-existing medical conditions.

(3) *Subsequent examinations.* (i) The employer shall provide appropriate medical examinations if the employer becomes aware that:

(A) The employee has accidently or otherwise been exposed to ammonia by ingestion, inhalation, or by skin or eye contact under conditions known or suspected to be hazardous or;

(B) The employee has developed either signs and symptoms associated with exposure to ammonia, or medical conditions as specified in paragraph (i) (2) (i) of this section.

(ii) The examinations shall be appropriate to the specific condition resulting from the employee's exposure to ammonia.

(4) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this regulation for ammonia including Appendixes A and B of this section;

(ii) A description of the affected employee's duties as they relate to the exposure to ammonia;

(iii) The results of the employee's exposure measurement, if available;

(iv) A description of any personal protective equipment used;

(v) The employee's estimated exposure level; and

(vi) Any information requested by the physician from previous medical examinations of the affected employee.

(5) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician, containing the following:

(A) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of his health from exposure to ammonia or which would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to ammonia and upon the use of protective equipment and respirators; and

(C) A statement that the employee has been informed by the physician of any medical conditions which require further examination or treatment.

(ii) The written opinion shall not contain specific findings or diagnoses unrelated to occupational exposures.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(6) *Withdrawal from exposure.* No employee shall be exposed to ammonia in such a way as would put the employee at increased risk of material impairment of his or her health from such exposure. This determination may be based on the physician's written opinion.

(j) *Employee information and training*—(1) *Training program.* (i) The employer shall provide a training program for employees assigned to workplace areas in which any ammonia is produced, released, stored, handled, packaged, repackaged, transported, or used.

(ii) The employer shall provide a training program at the time of initial assignment to workplace areas as specified above, and at least annually thereafter, which shall inform each employee of:

(A) The information contained in Appendixes A and B;

(B) The quantity, location, manner of use, release, or storage of ammonia and the specific nature of operations which could result in exposure above the ceiling limit, as well as any necessary protective steps;

(C) The purpose for, and a description of, the medical surveillance program as required by paragraph (i) of this section, including the requirement that the employee notify the employer when the employee has developed signs or symptoms associated with exposure to ammonia or has become aware of medical conditions listed in paragraph (i)(2)(i) of this section;

(D) The purpose, proper use, and limitations of respiratory protection devices as specified in § 1910.134;

(E) Emergency procedures as required by paragraph (h) of this section; and

(F) A review of the contents of this standard.

(2) *Access to training materials.* (i) The employer shall make a copy of this standard and its appendixes readily available to all employees working in operations where ammonia is present.

(ii) The employer shall provide, upon requests, all materials relating to the employee information and training program to the Secretary and the Director.

(k) *Labeling*—(1) *General.* (i) Labels required by this paragraph shall be in addition to, or in combination with, labels required by other statutes, regulations, or ordinances.

(ii) The employer shall ensure hat no statement appear on or near any required label or instruction which contradicts or detracts from the effect of any such required label or instruction.

(2) *Labels.* (i) The employer shall ensure that containers of anhydrous ammonia bear the following label:

AMMONIA, ANHYDROUS

WARNING! HAZARDOUS LIQUID AND GAS UNDER PRESSURE

LIQUID CAUSES BURNS

GAS EXTREMELY IRRITATING

Do not breathe gas.
Do not get in eyes, on skin, or clothing.
In case of contact immediately flush skin or eyes with plenty of water for at least 15 minutes. Call a physician at once in case of burns, especially to the eyes, nose and throat, or if the patient is unconscious.

CYLINDER HANDLING AND STORAGE

Keep away from heat.
Never drop cylinders.
Be sure connections are tight.
Never refill cylinders ICC Regulations prohibit refilling without permission of owner.
Have respirator available for emergency use.

(ii) The employer shall ensure that containers of strong aqua ammonia bear the following label:

AMMONIUM HYDROXIDE (STRONG AQUA AMMONIA)

WARNING! LIQUID CAUSES BURNS

GAS EXTREMELY IRRITATING

AVOID BREATHING GAS

Avoid contact with eyes, skin and clothing. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention.

HANDLING AND STORAGE

Keep container out of sun and away from heat.
Wear protective eye goggles when handling open containers.
Avoid rough handling or dropping.
Loosen closure carefully.
Before moving container be sure closure is securely fastened.
Do no mix with acids, chlorine bleach or other chemicals.
In case of spillage flush with plenty of water.

(iii) The employer shall ensure that containers of weak aqua ammonia bear the following label:

AMMONIUM HYDROXIDE (AQUA AMMONIA)

CAUTION! IRRITATING LIQUID AND GAS

Loosen Closure Carefully

Avoid Breathing Gas

Avoid contact with eyes, skin and clothing. In case of contact immediately flush skin or eyes with plenty of water for at least 15 minutes, for eyes, get medical attention. In case of spillage, flush with plenty of water.

(l) *Recordkeeping.*—(1) *Exposure determinations.* (i) The employer shall keep an accurate record of all determinations as prescribed by paragraph (d)(2) of this section.

(ii) The employer shall maintain this record for at least 1 year and shall include in it the most recent determination.

(2) *Measurement.* The employer shall keep an accurate record of all measurements taken to monitor employee exposure to ammonia.

(i) This record shall include:

(A) The date of measurement;

(B) The operation involving exposure to ammonia which is being monitored;

(C) The sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Name, social security numbebr, and exposure level of the employee measured; and

(F) The type of respiratory protective devices worn, if any.

(ii) The employer shall maintain this record for at least 1 year.

(3) *Mechanical ventilation measurements.* Whenever mechanical ventilation is used as an engineering control, the employer shall maintain a record of the measurements demonstrating the effectiveness of such ventilation as required by paragraph (e)(1)(vi) of this section.

(i) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken; and

(C) Results of measurement.

(ii) The employer shall maintain this record for at least 1 year.

(4) *Employee training.* The employer shall keep an accurate record of all employee training required by paragraph (j) of this section.

(i) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained; and

(C) Content or scope of training provided.

(ii) The employer shall maintain this record for at least 1 year.

(5) *Medical surveillance.* The employer shall keep an accurate medical record for each employee subject to medical surveillance required by paragraph (i) of this section.

(i) This record shall include:

(A) Physician's written opinion;

(B) Any employee medical complaints related to exposure to ammonia; and

(C) A copy of the information provided to the physician as required by paragraph (i)(4) of this section.

(ii) The employer shall maintain this record for the duration of employment of the affected employee plus 5 years.

(6) *Availability.* (i) The employer shall make available, upon request, all records required to be maintained by this section to the Secretary and the Director for examination and copying.

(ii) The employer shall make available upon request, written determinations and employee exposure measurements records required by paragraphs (l)(1) and (2) of this section for examination and copying to employees, former employees, and their designated representatives.

(iii) The employer shall make available, upon request, employee medical records required to be maintained by paragraph (l)(5) of this section for examination and copying to a physician

designated by an employee or former employee.

(7) *Transfer of records.* (i) If the employer ceases to do business, the employer shall transfer the records to the successor and the successor employer shall receive and retain all records required to be maintained by paragraph (l).

(ii) If the employer ceases to do business and there is no successor to receive and retain the records, the employer shall transmit these records by registered mail to the Director, and shall individually notify in writing each employee and former employee of this transfer.

(m) *Observation of monitoring.*—(1) *Employee observation.* The employer shall give employees or their representatives an opportunity to observe any measuring or monitoring of their exposure to ammonia which is conducted pursuant to this section.

(2) *Observation procedures.* (i) When observation of the measuring or monitoring of employee exposure to ammonia requires entry into an area where the use of respiratory protection or personal protective devices or both is required, the employer shall provide the observer with and require the use of such equipment and the compliance with all other applicable safety procedures.

(ii) Without interfering with the measurement, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the measurement of airborne concentrations of ammonia performed at the place of exposure; and

(C) Record the results obtained.

(n) *Effective date*—This standard shall become effective 30 days following publication of the final standard in the FEDERAL REGISTER.

(o) *Startup dates*—(1) *Determination and measurement.* The employer shall institute determinations and measurements prescribed in paragraph (d) of this section within 90 days of the effective date of the final standard, except that for new production areas or operations, the employer shall institute determinations and measurements within 30 days of startup of the new production areas or operations.

(2) *Medical surveillance.* The employer shall institute medical surveillance prescribed in paragraph (i) of this section within 90 days of the effective date of the final standard.

(3) *Emergency situations.* The employer shall develop and make available for implementation the written plan of action for emergency situations as required in paragraph (h) (1) (i) within 15 days from the effective date of this standard.

(p) *Appendixes*—The information contained in the appendixes to this section is not intended by itself to create any additional obligations not otherwise imposed by the standard or to detract from any existing obligation.

APPENDIX A—SUBSTANCE SAFETY DATA SHEET AMMONIA

I. SUBSTANCE IDENTIFICATION

Substance: Ammonia.

Permissible Exposure: A ceiling limit of 50 parts of vapor per million parts of air (ppm); (.005%).

Appearance and Odor: Ammonia can be either a liquid or a gas. In both forms it is colorless and has a strong, pungent, distinctive odor.

II. HEALTH HAZARD DATA

Ways in which the chemical affects your body: Ammonia can affect your body if you inhale it, swallow it or if it comes in contact with your skin or eyes.

Effects of overexposure:

A. Short-term (acute) overexposure: If you are overexposed to ammonia, your eyes, nose, and throat may become irritated. You may have difficulty breathing and your skin and eyes may be burned. In extreme cases, unconsciousness of death may result.

B. Reporting Symptoms: You should inform your employer if you develop any of the symptoms associated with ammonia.

III. EMERGENCY AND FIRST AID PROCEDURES

Eye Exposure: If ammonia is splashed in your eyes, wash it out immediately with large amounts of water. Call a doctor as soon as possible but not until after first aid is begun. Do not wear contact lenses when working with ammonia.

Skin Exposure: If ammonia is splashed or spilled on your clothing or skin remove contaminated clothing and wash the exposed skin with large amounts of water immediately. Wash contaminated clothing before you wear it again.

Breathing: If any person breathes in large amounts of ammonia, get the exposed person to fresh air at once. Do not try to rescue a person from high levels of ammonia unless you are wearing the proper respirator. Call a doctor as soon as possible. Give artificial respiration if the person is not breathing.

Swallowing: If the person is conscious and ammonia has been swallowed, get the person to drink large amounts of water to dilute the chemical. Do not try to make the person vomit. If the person does vomit place him or her face down with head lower than the hips to keep vomited material from entering the lungs.

IV. PROTECTIVE CLOTHING AND EQUIPMENT

Respirators: Respirators can only be required for routine use if your employer is in the process of installing controls. You must wear a respirator for non-routine activities or in emergencies if you are likely to be exposed to ammonia at levels above the permissible exposure. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA, formerly Bureau of Mines) or National Institute for Occupational Safety and Health (NIOSH approval label. If you can smell ammonia while wearing a respirator, the respirator is not working correctly. If you experience difficulty breathing while wearing a respirator, tell your employer.

Protective Clothing: You must wear impervious protective clothing (such as boots, gloves, sleeves, aprons, etc.) over any parts of your body that may be exposed to ammonia.

Eye and Face Protection: You must wear splashproof goggles if it is possible that ammonia may get into your eyes. You should wear a face shield if your face may get splashed with ammonia. Contact lenses should not be worn when working with liquid ammonia.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Ammonia gas or liquid should be stored in tightly closed containers in a cool, well ventilated area. Ammonia gas may form explosive mixtures in air. All sources of ignition must be controlled. You should use nonsparking tools when opening or closing metal ammonia containers. Fire extinguishers must be readily available. You should know where they are located and how to use them. You should know the location of any ammonia shut-off valves. Smoking is prohibited where ammonia is used or stored. Ask your supervisor where ammonia is used in your work area and any additional plant safety rules.

APPENDIX B—SUBSTANCE TECHNICAL GUIDELINES AMMONIA

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification.

1. Synonyms.

(a) Water-less liquid or gas: Anhydrous ammonia.

(b) Water-containing liquid: Aqua ammonia, ammonium hydroxide, ammoniacal liquor, ammonia liquor, ammonia water.

2. Formula.

(a) Anhydrous Ammonia: NH_3.

(b) Aqua Ammonia: NH_4OH.

B. Physical Data.

1. Boiling Point: −33.35° C. (−28° F) (Anhydrous Liquid).

2. Specific Gravity: 0.68.

3. Vapor Density: 0.0555.

4. Melting Point: 77.72° C (−107.9° F).

5. Vapor Pressure at 20° C (68° F).

6. Solubility in Water at 20° C (68° F): Very soluble.

7. Appearance and Odor: Colorless liquid and gas: strong, pungent, distinctive odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire.

1. Flash Point: Not Applicable

2. Autoignition Temperature: 651° C (1204° F)

3. Flammable Limits in Air % by volume: Lower: 16% Upper: 25%

4. Extinguishing Media: Dry Chemical, Carbon Dioxide

5. Special Fire Fighting Procedures: Use water spray to cool fire exposed containers. Stop flow of gas.

6. Unusual Fire and Explosion Hazards: Ammonia gas is flammable in air only at comparatively high concentrations. However, the presence of oil, or a mixture of ammonia with other combustible materials will increase the fire hazard, and the explosive range is broadened by:

(a) Admixture of oxygen replacing air.

(b) Temperature and pressure higher than atmospheric. Hose streams are comparatively effective in removing gas from the atmosphere.

7. A concentration of atmospheric ammonia exceeding 40,000 ppm shall be considered a potential fire or explosion hazard. Loca-

tions where ammonia may be present are considered Class I Group D for the purposes of conforming to the requirements of 29 CFR 1910.309.

B. Reactivity.

1. Conditions Contributing to Instability: Heat.

2. Incompatibility: Oxidizing materials, chlorine bleach, acids.

III. SPILL AND LEAK PROCEDURES

A. Steps to be taken if material is released or spilled: Large amounts of water spray should be used to flush the spills. Water sprays can be used to remove ammonia gas from the air due to high solubility of ammonia in water. Ventilate enclosed spaces.

B. Persons not wearing protective equipment should be restricted from areas of spills until clean-up has been completed.

C. Waste disposal method: Disposal methods must conform to other jurisdictional regulations. If allowed, ammonia may be disposed by diluting with large quantities of water and washed into sewers.

IV. MONITORING AND MEASUREMENT PROCEDURES

Monitoring Program: Measurements taken for the purpose of determining employee exposure under this section are to be taken in a fashion such that exposure to the ceiling concentration may be determined from a series of samples of not more than five (5) minutes duration. A minimum of three (3) samples shall be taken for each operation. At least one blank impinger shall be provided containing absorbing solution through which no air has been sampled. One additional blank impinger shall be provided with every ten (10) samples obtained. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analysis may be performed by instruments, such as detector tubes certified by NIOSH under 42 CFR/Part 84, portable direct-reading instruments, gas and vapor absorption tubes with subsequent chemical analyses, dosimeters or with continuous monitoring systems that can sample and analyze those areas most likely to represent the highest airborne concentrations of ammonia where employees are exposed. Portable direct-reading instruments should be NIOSH certified and should receive regular maintenance and calibration. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The analytical method must determine the concentration of ammonia to plus or minus 25%.

V. MISCELLANEOUS PRECAUTION

A. Accidental spills or leads of ammonia may occur during transfer operations from one container to another. All connections should be checked thoroughly for tightness and possible leaks. All lines should be checked for structural integrity.

B. Although ammonia is a fire and explosion hazard only at high concentrations, such concentrations may exist near open containers or if leaks are present. Smoking should be prohibited in all ammonia handling, use and storage areas.

C. Employers should advise employees of all plant areas and operations where exposure to ammonia can occur. A few examples of areas where ammonia exposure may occur are: Laboratories, nitriding furnaces, fertilizer manufacturing, explosives manufacturing, coke making, diazo-type reproducing operations.

(Secs. 4, 6, 8, 84 Stat. 1592, 1593, 1599 (29 U.S.C. 653, 655, 657) and 29 CFR Part 1911)

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